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Research Note

Effect of Grape Seed Extract on the Physicochemical and Sensory Properties of Chicken Nuggets

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ABSTRACT

The present study was designed to evaluate the possibility of utilization of grape seed extract in the development of designer chicken nuggets. The products were developed by incorporating different levels of grape seed extract (0.1%, 0.2%, and 0.3%) and were analyzed for various physicochemical and sensory parameters. A significant ($p<0.05$) effect of grape seed extract was observed on the pH and moisture content of the chicken nuggets. The grape seed extract significantly ($p<0.05$) improved various sensory attributes of the products. A significant ($p<0.05$) increase was observed in colour and appearance, flavour, juiciness and overall acceptability of nuggets incorporated with grape seed extract. Thus, chicken nuggets of good to very good acceptability could be prepared by incorporating grape seed extract up to 0.3% level in the formulation.

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Dietary antioxidants have been suggested to have the capability to prevent the oxidative damage in the body and reduce the risk of several diseases like cardiovascular diseases, some cancers, Alzheimer's disease, and impairment of vision (Holm 2003). The antioxidants also reduce the susceptibility of foods to oxidation and reduce the production of harmful products. Various plant obtained ingredients have been added to the meat products during processing and enough literature is available regarding the use of polyphenolics from various types of sources like green tea, rosemary, sage, seabuck thorn, etc. which have been studied alone or combined with other ingredients. However, very little literature is available about the use of grape seed extract in the development of functional meat products. Grapes (*Vitis vinifera*) have been heralded for the medicinal and nutritional value for thousands of years. Among all the parts of a grape, grape seeds are believed to have powerful antioxidant properties due to their high content of polyphenolic compounds. The polyphenolic compounds are as much as 60-70% in grape seeds compared to only 10% in the fruit and 28-35% in the peels (Nawaz *et al.* 2006). Most of the polyphenolic compounds found in grape seeds are flavonoids, catechins, and epicatechins, which are of interest in pharmaceutical and food factories for medical treatment and health supplements (Nawaz *et al.* 2006). Poultry industry is globally gaining more importance in the present era because of its higher consumer acceptance and freedom from religious taboos. Poultry meat is categorized as white meat and has healthier fat profile from nutritional perspective i.e. low saturated fat and high mono- and poly-unsaturated fatty acids (Sotelo and Perez 2003).

Keeping in view all the above facts, the present study was envisaged to attempt the still inconclusive studies on utilization of grape seed extract in the development of functional muscle foods. Thus a study was designed to evaluate the effect of different levels of grape seed extract on the quality characteristics of chicken nuggets.

Preparation of chicken nuggets

The body fat was trimmed and deboning of dressed chicken was done manually by removing all the tendons and separable connective tissue. Condiments used in the study were onion, garlic and ginger paste in a ratio of 3:2:1. Refined Soyabean oil from local market was used in emulsion preparation. Commercially available grape seed extract (*Vitis vinifera*) manufactured by Medizen Labs Pvt. Ltd., India was used in the experiments. The solutions of different strengths (0.1%, 0.2%, and 0.3%) were prepared in double distilled water and used for replacing lean meat in the formulation.

The standardized formulation for emulsion contained lean meat 68.2%, vegetable oil 10%, added water 10%, condiment mixture 3%, refined wheat flour 4%, egg liquid 2%, spice mixture 2%, table salt 2%, sucrose 0.5%, sodium tripolyphosphate 0.3% and sodium nitrite 150 ppm. Meat emulsion was stuffed in stainless steel moulds and subjected to steam cooking for 30±2 minutes in a pressure cooker. The

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internal temperature was monitored by a thermometer and cooked to an internal temperature of 78±2^{0}C.

Physico-chemical analysis

The pH of the product was determined by the method of Keller *et al.* (1974). The individual weight of products was recorded before and after cooking. The cooking yield was calculated and expressed as percentage. The emulsion stability of meat emulsion was estimated as per procedure described by (Townsend *et al.* 1968) with some modifications. Loss of weight after cooking was calculated and expressed (in percentage) as an index of emulsion stability.

The moisture, protein, fat and ash content of chicken nuggets were determined by standards method using hot air oven, Kjeldahl assembly, Soxhlet extraction apparatus and Muffle furnace respectively as per AOAC (1995). The sensory evaluation of fresh and stored samples was carried out for various attributes namely appearance, flavour, juiciness, texture and overall acceptability by a panel of trained members composed of scientists and research scholars of the division based on a 8-point hedonic scale, wherein 8 denoted "extremely desirable" and 1 denoted "extremely undesirable" (Seman *et al.* 1987).

Data obtained in the study was analysed statistically on 'SPSS-16.0' software package as per standard methods (Snedecor and Cochran 1994). Duplicate samples were drawn for each parameter and the experiment was replicated three times (n=6). Sensory evaluation was performed by a panel of seven trained members three times (n=21). The data obtained was subjected to statistical analysis for one way analysis of variance.

The mean values of various physicochemical parameters of the products incorporated with different levels of grape seed extract are presented in Table 1. A significant ($p<0.05$) decreasing trend was observed in the pH of chicken nuggets with the increase in the level of incorporation of grape seed extract. This decrease in pH may be attributed to acidic and polyphenolicic compounds present in grape seed extract (Oomah *et al.* 1998). This is in agreement with Ibrahim *et al.* (2012) who also observed reduction in the pH of the cooked nuggets prepared with incorporation of pomegranate rind, seed extracts and pomegranate juice. Similar results were also reported by Kim *et al.* (2013) who also observed similar findings in cooked pork patties prepared with tomato powder.

Table1: Effect of grape seed extract on the physicochemical and proximate parameters of chicken nuggets (Mean±SE)*

	Levels of grape seed extract (%)			
Parameters	**0**	**0.1**	**0.2**	**0.3**
pH	6.17^a±0.00	5.98^b±0.01	5.97^b±0.01	5.73^c±0.04
Emulsion stability (%)	90.38±0.70	90.0±1.13	89.53±0.83	88.95±2.38
Cooking yield (%)	91.43± 0.53	91.98± 0.68	92.71± 0.78	93.33± 0.85
Moisture (%)	62.09^b±0.19	62.58^b±0.23	63.75^a±0.42	64.65^a±0.48
Fat (%)	12.29±0.10	12.31±0.12	12.58±0.07	12.65±0.20
Protein (%)	17.31±0.42	17.63±0.42	16.62±0.61	16.52±1.04
Ash (%)	2.56±0.19	2.22±0.26	1.98±0.20	1.83±0.29

*Mean ± SE with different superscripts in a row differs significantly ($p<0.05$), n = 6

No significant ($p>0.05$) difference was observed in the emulsion stability of chicken nuggets with the incorporation of grape seed extract. Sen *et al.* (2012) also reported that emulsion was stable in the formulation added with grape fibre. A non-significant ($p>0.05$) increase was observed in the cooking yield of chicken nuggets with increase in the level of incorporation of grape seed extract. This increase in cooking yield is correlated with increase in moisture content of the treated products. This is in agreement with the findings of Sen *et al.* (2012) who also reported a significant ($p<0.05$) increase in the cooking yield of chicken nuggets prepared with addition of grape fibre.

An increase in moisture percentage was recorded and it was significantly ($p<0.05$) higher at 0.2% and 0.3% level of incorporation as compared to control, however, at 0.1% level it was comparable to control. This result is in accordance with Sen *et al.* (2012) who also observed a significant increase ($p<0.05$) in moisture content of chicken nuggets incorporated with grape fibre. No significant ($p>0.05$) difference was

observed in the fat content of chicken nuggets with the incorporation of grape seed extract. Although, a non-significant increase in fat percentage was recorded that may be attributed to the high fat content of grape seeds. Oomah *et al.* (1998) reported that grape seed extract is rich source of phenols and steroids (campestrol, beta-sitosterol, stigmasterol). According to Black *et al.* (2006) grape seed oil is used as an ingredient for oil infusion of garlic, rosemary and other herbs and spices.

No significant ($p>0.05$) change was observed in the protein and ash content of chicken nuggets incorporated with grape seed extract. Although, a non-significant decrease may be attributed to low ash content of grape seed extract. This is in agreement with Sen *et al.* (2012) who also observed similar finding in chicken nuggets containing grape fibre.

The mean values of various sensory parameters of the products prepared with addition of grape seed extract are presented in Table 2. A significant ($p<0.05$) influence was observed on colour and appearance, flavour, juiciness and overall acceptability of nuggets incorporated with grape seed extract. Colour and appearance scores of the nuggets improved significantly ($p<0.05$) with the incorporation of grape seed extract and the scores for 0.2% and 0.3% level were significantly ($P<0.05$) higher in comparison to control. The red colour and astringency taste of the grape seed extract can be attributed to polyphenolic rich compounds especially proanthocyanidins which may affect the colour and sensory characteristics of the meat products (Monteleone *et al*. 2004). This is in agreement with the study of Brannan (2008).

The scores for flavour were significantly ($p<0.05$) higher for the chicken nuggets prepared with the incorporation of 0.3% of grape seed extract than control. The increased flavour in the treated products might be due to the unique flavour imparting property of the grape seed extract. This increase in flavour scores of the treated chicken nuggets may also be attributed to the bioactive ingredients of grape seed extract having antimicrobial, antifungal and antioxidant properties which may have resulted into less production of rancid metabolites and flavours. Grape seed extract is a rich source of polyphenolic compounds and contains linoleic acid, polyphenols, lipids, carbohydrates, proteins, anthocyanins, proanthocyanidins and oligomericproantho-cyanidins. Most of the polyphenolic compounds found in grape seeds are flavonoids, catechins and epicatechins. Rojas and Brewer (2007) reported that even low levels of grape seed extract (0.02%) improved the sensory quality of beef and pork patties.

A significant ($p<0.05$) increase was recorded in juiciness scores at all levels as compared to control. Increase in juiciness might be due to increased moisture content in treated products. No significant ($p>0.05$) change was observed in the texture of chicken nuggets prepared by addition of grape seed extract in comparison to control. A significant ($p<0.05$) increasing trend was observed in overall acceptability scores with increasing level of incorporation. This could be attributed to comparatively higher scores for other sensory attributes of the treated products viz. colour and appearance, flavor and juiciness. Rojas and Brewer (2007) reported similar results in beef and pork patties incorporated with grape seed extract.

The grape seed extract significantly ($p<0.05$) improved the sensory properties of chicken nuggets without adversely affecting the physicochemical properties of the products. Grape seed extract improved the mean scores for various sensory parameters like colour and appearance, flavor, juiciness and overall acceptability. Thus, chicken nuggets with improved acceptability could be prepared by incorporating grape seed extract up to 0.3% in the formulation.

Table 2: Effect of grape seed extract on the sensory attributes of chicken nuggets (Mean±SE)*

	Levels of grape seed extract (%)			
Parameters	0	0.1	0.2	0.3
Colour and appearance	$6.87^{c}\pm0.11$	$7.29^{b}\pm0.09$	$7.65^{a}\pm0.07$	$7.48^{ab}\pm0.10$
Flavour	$7.21^{b}\pm0.12$	$7.35^{b}\pm0.08$	$7.42^{b}\pm0.07$	$7.75^{a}\pm0.07$
Juiciness	$7.15^{c}\pm0.05$	$7.44^{b}\pm0.08$	$7.63^{ab}\pm0.08$	$7.71^{a}\pm0.06$
Texture	7.30 ± 0.10	7.53 ± 0.11	7.57 ± 0.16	7.41 ± 0.10
Overall acceptability	$7.16^{b}\pm0.13$	$7.35^{ab}\pm0.11$	$7.50^{a}\pm0.09$	$7.65^{a}\pm0.08$

*Mean ± SE with different superscripts in a row differs significantly ($p<0.05$)

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